The label 28 may also be a physical feature such as a tab whose position is interpretable by the label reader 38; e.g., different tab positions relate to different data files.

The field illuminator 40 includes a light source 44, objective optics 46, and preferably a light filtering means 48. The light source 44 selectively produces light throughout a wavelength range broad enough to be useful for a plurality of analyses (e.g., approximately 340nm to 670nm), from a mechanism such as a fifty watt zenon arc lamp or tungsten halogen lamp, or a pulsatile source of about ten joules. Other light sources may be used alternatively and the wavelength range of the light source may vary depending upon the application. Alternatively, a light source 44 which selectively produces particular wavelengths of light within the above identified range, or a plurality of light sources 44 each of which produces particular wavelengths within the above identified range, may be used. The objective optics 46 include a focusing mechanism 50 for adjusting the position of an objective lens 52 relative to the container 18 (or vice versa). The objective lens 52 focuses light emanating from the light source 44 into a light beam 54 which, in turn, is directed into the sample quiescently residing within the chamber 20. The light beam directed into the sample is of sufficient area to illuminate at least one imaged field of the sample. The sample field is defined by the cross-sectional area of the sample image which impinges on the image dissector 42, or a portion thereof, as directed by the objective optics 46 and any intervening field stops. The light filtering means 48, when included, is used to improve the quality and/or clarity of the desired sample image for a given test or to allow a precise quantitative measurement of light energy emitted from, or passing through, relevant portions of the sample. If the light source 44 is capable of selectively producing particular wavelengths, it may be possible to omit the light filtering means 48.

The preferred embodiment of the field illuminator 40 varies depend upon the principle used to produce the image. Referring to FIG.4, a first embodiment of the field illuminator 40 utilizes fluorescence to produce an image. The first embodiment includes a flash tube type light source 44, optics 46, and a light filtering means 48, the latter of two which include a first

lens 56, a light source excitation filter 58 ("LSE" filter), a light diverting prism 60, a reference detector 62, an objective lens 52, a sample emission filter 66 ("SE" filter), a second lens 67, and a focusing mechanism 50. The light diverting prism 60 may be a polarizing prism, a dichroic beam splitter, or a half-silvered mirror or prism. The first lens 56 collects light emanating from the flash tube, or alternate source of illumination, and directs it through the LSE filter 58. The LSE filter 58 allows light of a predetermined wavelength(s) to pass through (this function can also be described as blocking all but predetermined wavelengths from passing through) and continue on where it strikes the light diverting prism 60. A portion of the light then passes through the light diverting prism 60 and strikes the reference detector 62 positioned adjacent the light diverting prism 60. Feedback from the reference detector 62 allows the filtered excitation light energy to be measured. Since fluorescence emission is directly proportional to the energy of the fluorescence excitation, any variations in the excitation light energy, as measured by the reference detector 62, can be used to either adjust the intensity of the emission source or to calculate a corrected emission energy. Another portion of the light entering the light diverting prism 60 is reflected approximately ninety (90) degrees downward through the objective lens 52 and subsequently into the container chamber 20 where the biologic fluid sample quiescently resides. The objective lens 52 is attached to the focusing mechanism 50 that enables the distance between the objective lens 52 and the chamber 20 to be varied as necessary for focusing purposes. A controllable stepper motor arranged to change the focal distance between the objective lens 52 and the container 18 is an example of a focusing mechanism 50. Typically, the objective lens 52 is moved relative to the container 18, or vice versa, but alternative methods may be used. The wavelengths of light passing through the LSE filter 58 and the objective lens 52 subsequently enter the sample, causing material within the sample bearing a chosen colorant to fluoresce and emit light of a particular wavelength. That emitted light passes back through the objective lens 52, through the light diverting prism 60, and then through the SE filter 66. The SE filter 66 blocks all but (or passes) select wavelengths of light. Those wavelengths of light subsequently pass through

the second lens 67 and encounter the image dissector 42. The SE filter 66 is preferably a tunable liquid crystal display (LCD) filter.

If there is more than one LSE filter 58, the LSE filters 58 are attached to a first filter wheel 68. The first filter wheel 68 is synchronized with the light source 44 such that the light source 44 is selectively actuated when the desired LSE filter 58 is positioned in the path of the light beam 54 as described above. Likewise, if there is more than one SE filter 66, the SE filters 66 are attached to a second filter wheel 70. The second filter wheel 70 is synchronized with the light source 44 such that the light source 44 is selectively actuated when the desired SE filter 66 is positioned in the path of the light beam 54. If there is more than one LSE filter 58 and more than one SE filter 66, then the first and second filter wheels 68,70 and the light source 44 are synchronized such that the light source 44 is selectively actuated when the desired LSE and SE filters 58,66 are positioned in the path of the light beam 54.

Referring to FIG.5, the second embodiment of the field illuminator 40 utilizes transmittance to produce an image. In the second embodiment of the field illuminator 40, measurement of the light transmission properties of the sample is accomplished by positioning a white light source 44 and a first lens 56 under the sample residing within the chamber 20 and directing the light through the chamber first wall 30 (which is transparent in this embodiment), the sample, the chamber second wall 32, the objective lens 52, the SE filter 66, the second lens 67, and thereafter to the image dissector 42. The transmittance light is intermittently energized as transmittance measurements are required. The light source 44 may be pulsatile, such as from a flash tube, or it may be an incandescent bulb with a means for selectively exposing the sample to the light such as a shutter, or an electronic switch that extinguishes the light entirely.

The preferred image dissector 42 is a charge couple device (CCD) capable of providing at least eight bits of resolution and preferably twelve bits of resolution per pixel. The image dissector 42 converts an image of the light passing through the SE filter 66 into an electronic data format which can be seen and/or interpreted in real-time or at a subsequent time using a